AN AUTOMATIC VAULT CLEANER.

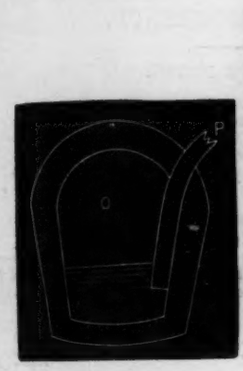
(Translated for ENGINEERING NEWS.)

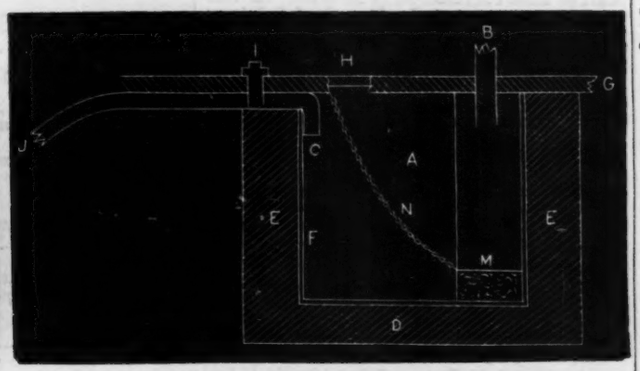
The principles on which M. Mouras bases the action of this machine is that the animal dejecta contain within themselves all the principles of fermentation or of dissolution necessary and sufficient to liquify them, and to render them immediately useful in their return to the soil and without appreciable loss.

In the figure, *A* is the vault, *B* the soil-pipe from the house, *C* the syphon discharge pipe, *D* concrete foundation, *E* walls, *F* plastering in cement, *G* flagstone curbs, *H* man-hole to the vault, *I* plug for inspection, *J* drain-pipe to the street sewer, *M* box of sand to catch any solids which may accidentally enter through the soil-pipe, *N* chain holding this box and by which it may readily be turned up to the man-hole and cleaned out, *O* street sewer with house-drain, *P* trapped by the sewer water.

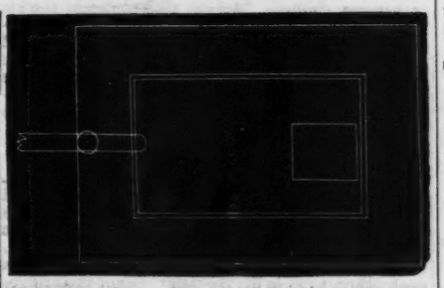
The vault may be constructed of any material which can be made water and air tight, of a capacity of one cubic meter to suffice for the service of a house of from 20 to 25 persons. The vault being filled with water, the tightness of the construction and the traps cut off all emanations or escape of gas from the interior into the house.

After the fecal matters enter the vault in sufficient quantities, the liquid becomes turbid and of a brown color but however long continued it may be used, providing that the urine and waste waters enter with it, a fermentation takes place which dissolves all the fecal matters, even the most solid, into particles or filaments so small as scarcely to be discernable, without any deposit adhering to the walls or sides of the pipes.





Nothing is more insoluble in itself than fecal matter, as it is covered by an animal grease or mucus, which prevents the water from acting upon it. Experiments were made by means of a vault with glass sides, like an aquarium, perfectly sealed. There being discharged into this aquarium but fecal matters and a very small percentage of water, yet the liquefaction of the excrements was complete, without any deposition—all remained in suspension. Introduced Aug. 19, the solid dejecta were completely liquefied by Sept. 16, with the exception of the undigested matter, such as seeds and skins of grapes, and some kitchen refuse of vegetable, such as carrots and onion peelings. These floated for a time and then fell to the bottom to await decomposition. Paper disappeared in a like manner. About a liter in bulk of the urine fecal matter and a little water, taken from the aquarium, exhaled but little odor; diluted with 100 times its bulk of water, it was limpid and inodorous. Twenty days in succession there was thrown into the aquarium, with the ordinary fecal matter, about 10 liters of a mixture of urine and soap suds, so as to render the condition as near as may be that of an ordinary cess-pool, and the result was, that the fecal matters always swam upon the surface, forming a sort of scum, never exceeding 5 centimeters in thickness, owing apparently to the constant dissolution going on below. On adding 10 liters of water, the matters not digested, such as vegetables or fruit skins, disposed themselves on the top in the order of their specific gravity, and then, after a time, fell to the bottom to wait their decomposition, which, operated insensibly, but efficiently, the deposit not being sedimentary, but gradually mixing with that above, was discharged with the liquid of the aquarium without any foreign matters appearing in suspension. No pressure from gas is apparent, as was shown by a pipe fixed in the top of the aquarium with a bladder attached, not being distended. On taking off the cover *H*, no bad odor was given out, until the air had time to act, when gas began to rise, and, on closing the opening, the bladder became extended. The operation, to be complete, it would seem the apparatus must be air as well as water tight. The dissolution of matter seemed more active the greater the quantity of water supplied, which admits therefore of the introduction of house and rain water—but they are not indispensable.



BROOKLYN WATER-WORKS.

Form and date of Proposals to be seen in our advertising columns.

SPECIFICATIONS FOR STEAM PUMPING ENGINE AT RIDGEWOOD ENGINE HOUSE, EAST NEW YORK, ENGINE NO. 4.

FOUNDATION OF ENGINE.—I. The sub-foundation (by which is meant only excavation and preparation of bottom for the reception of masonry to be furnished by the contractor) will be made by the city, the contractor of the accepted design having furnished the requisite dimensions and depth of foundation. Upon this bottom the contractor will erect the requisite masonry foundations for his engine and for the building inclosing the engine. The contractor will be allowed to utilize the present foundations in the engine house, if the design of engine will permit. In case the engine shall be designed to be placed entirely outside of the present engine house, the contractor shall erect a suitable building of the same general character and design as the buildings now erected, or the contractor may enlarge the present engine house so as to receive the new engine, said enlargements to carry out the present character of the building, the design for such building or enlargement to be approved by the commissioner. No plan of engine will be accepted that necessitates any alterations to either of the engines at present in the engine house, or interferes in any way with the running of these engines. The entire work of the foundations and buildings to be subject to the inspection and approval as to design, material and workmanship, of the chief engineer of the Department of City Works.

PLANS OF ENGINE.—II. No plans will be considered which are experimental. The competition between designs will be confined to those of known and approved forms, such as may be seen in operation as pumping engines of reasonable size, and which can point to a record of performance. Nor will a design be accepted simply because certain results are guaranteed, irrespective of considerations of simplicity, durability and liability to accidents, which, duly considered, might, in the opinion of the commissioner, justify their rejection. Beyond this the design is left to the builder. It is the intention that the proposed engine should be connected with the present boiler under their present conditions of working pressure, but should the design of engine not permit of the use of the present boilers, the contractor must include in his bid the expense of independent boilers, boiler house, new chimney and chimney connections, and the boilers properly erected and connected to the engine and to each other.

CAPACITY OF ENGINE.—III. The capacity of the engine to be 15,000,000 gallons delivered into the reservoir in twenty-four hours, and the capacity to be determined by weir measurement at the reservoir. The static head is 161 ft., and the length of 3-ft. main from wall to reservoir 3,400 ft. The new force main of 36-in. diameter will be laid by the city.

STANDARD OF MATERIALS.—IV. All the materials used must be of the very best quality and the workmanship of the very best character. That accuracy of workmanship which is necessary to obtain durability, maximum economy in working, with minimum friction of parts, will be demanded.

DUTY OF ENGINE.—V. The duty of the engine to be 650,000 lbs. ft. per 1 lb. of good quality of anthracite coal fed upon the grates when delivering the guaranteed rate of 15,000,000 gallons in twenty-four hours, and to be the amount of work done divided by the coal used. No deductions for ashes or cinders.

RADIATION.—VI. The cylinders to be covered with such non-conducting material as may be agreed upon, lagged with narrow staves of black walnut secured with brass hoops.

JACKETING.—VII. The steam pipes are also to be thoroughly protected throughout their whole length and lagged in the same manner within the engine room. The steam cylinder to be steam jacketed in the most thorough manner and with provision for delivering the water of condensation from the jacket either into the boilers or through a steam trap.

CONNECTIONS.—VIII. All the steam and water connections with the boilers, and water connections with the well must be made by the contractor. The water connection with the rising main will be done by the Department.

TIME OF COMPLETION.—IX. The bidder must state the time he will require for completing the work and starting the engine in the performance of the above described work, said time of starting not to be later than one year after signing contract, under the forfeiture of the sum of one hundred dollars per day as liquidated damages, for each day after said date that the engine is not completed.

PROPOSALS—X. The proposals shall be accompanied with such drawings and specifications of dimensions as are necessary for a clear understanding of the proposal, and references to engines of like description at work, as to enable the engineer of the department to judge of the character of the machine. The bidders must state separate prices for engine, or engine boilers and new chimney, if the design calls for the same; for foundations and for new building or enlargement of present building. He must also submit drawings for new building or enlargement of present building, foundations, new chimney, boilers, etc. Two bonds of $50,000 each must accompany each proposition, conditioned that the bidder will enter into contract, if his bid shall be accepted within sixty days after the opening of bids.

TEST OF ENGINE—XI. When in the opinion of the contractor the engine is complete, there shall be a preliminary test of not less than forty-eight hours, of its capacity and duty at one and the same time.

CAPACITY—XII. The test for capacity shall be the delivery into the reservoir of 30,000,000 gallons in forty-eight hours, and this capacity shall be determined either by its measure by weir during the whole forty-eight hours or by the determination of the capacity of the pumps for a term of hours, and multiplying the capacity thus determined by the whole number of strokes during the period of test, as the engineers of the department may select.

DUTY.—XIII. In the test for duty the amount of work done shall be estimated by the pounds of water raised into the reservoir, multiplied by the lift, and the lift shall be taken at 171 ft. as established by experiments made upon the other force mains. In determining the amount in pounds of coal fed upon the grates, previous to the test, the boilers will be fired up and the engine run for at least one hour at its usual speed. The engine will then be stopped, fires drawn and rekindled as speedily as possible. Wood used for re-kindling to be charged to the test at two pounds of wood for one of coal, and all coal fed upon the grates to the end of the test to be charged to the engine. No allowance of any sort for cinder, fine coal or slate to be made; the engine to be run as long as the pressure and height of water in the boilers at which they were started are maintained.

PAYMENTS.—XIV. If the engine under this trial complies with the terms of the contract for capacity and duty, the contractor then to be paid up to 90 per cent. of the amount of the contract. But if the engine does not come up to the terms of the contract, one month to be allowed to the contractor for any alterations that he may deem necessary to bring it within the terms of the contract, after which it shall be again tested, and if not then within the terms of the contract, it shall be optional with the commissioner to reject the engine, or to accept it at such a reduction in price as may be determined upon.

PROBATION.—XV. Should the engine go through the test satisfactorily, it then shall be placed on its working trial or probation. This term shall be

runs aggregating 5,000 hours and to be completed within the limits of a year. During this term the engineer of the department shall from time to time test the engine as in the preliminary tests, and from the tests thus made, he shall at the conclusion of the term make up the duty of the engine; and if this duty is less than 650,000 lbs. ft. as specified by the contract, the contractor to forfeit $2,000 for every 10,000 lbs. ft. of duty, and any difference of duty below the specified duty shall be upon this basis. The contractor to select the coal, which must be anthracite; but should the coal furnished by the department not be selected by the contractor, the department will furnish at least 20 tons of that selected and have it carefully compared for evaporative capacity with that used by the department, and the contractor will be credited on the comparison, whenever the coal furnished is used. During the probation term of the engine, the contractor to furnish one engineer, to be paid by the department at the same wages as their engineers, who may make such slight repairs as is customary among engineers without any record of the same, but all material and outside work, by whomsoever furnished to be charged to the account of repairs.

PAYMENTS.—XVI. Thirty per cent. to be paid on the delivery of two-thirds of the material at the engine-house, properly fitted and prepared for setting up; 30 per cent. when all the material so fitted and prepared is delivered and pump set; 30 per cent. as soon as a successful test has been made; the balance when the requirements of the contract are fulfilled.

INSPECTION.—XVII. During the construction of the engine, it shall be open at all times to the inspection of the engineer of the department, who may object to any part that seems to him deficient, either in strength or quality of materials, proportion of parts, or workmanship, and in case of a difference of opinion on these points between him and the contractor, the decision of a competent mechanical expert, mutually agreed upon, shall be accepted by both parties, and shall determine the point in controversy.

ENGINEER.—XVIII. The chief engineer shall have the right, with the consent of the commissioner, to appoint an inspector of the work, and to select an engineer to make the tests, or to associate with himelf an engineer to determine upon the merits of the propositions submitted.

DRAWINGS.—XIX. Before the final payment is made, the contractor shall furnish to the department a full set of drawings of the details of engine, foundations, etc., suitable for binding.

SECURITY.—XX. The party to whom this contract is awarded will be required to give satisfactory bonds with sureties, residents of the city of Brooklyn or New York, for the satisfactory and faithful execution of the same, the amount of the bonds to equal the amount of the contract.

CHANGE IN PROPOSITION.—XXI. Should any bidder desire to present plans for two or more engines, having collectively a capacity of 30,000,000 gallons in forty-eight hours, such a proposition will be considered. The above specifications shall apply in all particulars to each of such engines, and all conditions above stated shall govern such a bid.

PREHISTORIC TIDES.

Prof. Ball, of England, in a recent lecture gave the following interesting account of prehistoric tides.

At present the moon is 240,000 miles away, but there was a time when the moon was only one-sixth part of this, or say, 40,000 miles away. That time must have corresponded to some geological epoch. It may have been earlier than the time when Eozoon lived. It is more likely to have been later. I want to point out that when the moon was only 40,000 miles away, we had in it a geological engine of transcendent power. If the present tides be 3 ft., and if the early tides be 216 times their present amount, then it is plain that the ancient tides must have been 648 ft. There can be no doubt that in ancient times tides of this amount, and even tides very much larger, must have occurred. I ask the geologists to take account of these facts, and to consider the effect—a tidal rise and fall of 648 ft. twice every day. Dwell for one moment on the sublime spectacle of a tide 648 ft. high, and see what an agent it would be for the performance of geological work! We are now standing, I suppose, some 500 ft. above the level of the sea. The sea is a good many miles from Birmingham, yet if the rise and fall at the coasts were 648 ft., Birmingham might be as great a sea-port as Liverpool. Three-quarters tide would bring the sea into the streets of Birmingham. At high tide there would be about 150 ft. of blue water over our heads. Every house would be covered, and the tops of a few chimneys would alone indicate the site of the town. In a few hours more the whole of this vast flood would have retreated. Not only would it leave England high and dry, but probably the Straits of Dover would be drained, and perhaps even Ireland would, in a literal sense, become a member of the United Kingdom. A few hours pass, and the whole of England is again inundated, but only again to be abandoned.

These mighty tides are the gift which astronomers have now made to the working machinery of the geologist. They constitute an engine of terrific power to aid in the great work of geology. In the great primeval tides will probably be found the explanation of what has long been a reproach to geology. The early palæozoic rocks form a stupendous mass of ocean-made beds, which, according to Prof. Williamson, are 20 miles thick up to the top of the silurian beds. It has long been a difficulty to conceive how such a gigantic quantity of material could have been ground up and deposited at the bottom of the sea. The geologists said: "The rivers and other agents of the present day will do it if you give them time enough." But, unfortunately, the mathematicians and the natural philosophers would not give them time enough, and they ordered the geologists to "hurry up their phenomena." The mathematicians had other reasons for believing that the earth could not have been so old as the geologists demanded. Now, however, the mathematicians have discovered the new and stupendous tidal grinding engine. With this powerful aid the geologists can get through this work in a reasonable period of time, and the geologists and the mathematicians may be reconciled.

RECENT INVENTIONS.

DRIVING PILES BY ELECTRICITY.

The successful application of electricity in new fields of labor continues to be recorded. At Hatfield Park, the seat of the Marquis of Salisbury, the piles to support a coffer-dam across the River Lea have just been successfully driven by the power of a water-wheel situated at a distance, which power was transmitted by two dynamo machines to the gearing connected with the pile-driver of ordinary construction erected on a barge floating in the river. The machinery worked well, lifting a monkey weighing about 400 lbs. with ease and regularity. It is not stated how far the power was transmitted. By a French experiment M. Deprez has succeeded in obtaining successful work after the current had passed through 49 miles of ordinary telegraph wire.

DUMPING CARS BY COMPRESSED AIR.

The platform of the car is made in two longitudinal sections, which are hinged each to its respective side of the car-frame. Air cylinders are attached beneath transverse timbers of the car-frame, and are provided with pistons having oval heads working upward through openings in said transverse timbers. An air pipe connects the air cylinders, and is attached to any suitable compressed air apparatus. Stop-cocks are provided which regulate the flow of compressed air into the cylinders, the pistons of which, responding to the pressure, permit the oval heads to raise the platform sections, and discharge their loads to the right and left.

DRAW BRIDGE.

The span is made in two sections or trusses, each truss of which spanning an opening, and hinged at its inner end to the turn-table. Flexible connections at the inner ends of the upper chords are deflected at their middle part from a right line, thereby causing such upper chords to approach each other, so as to lift the outer ends of the bridge. Such deflection is effected by a right-and-left-hand screw.

NOVEL FAUCET.

This improvement consists of a disk located in the faucet casing. A valve is carried by the disk so connected therewith that the passage of liquid from the under to the upper side of the disk is effectually precluded. A screw-lever is employed for adjusting said disk to shift the valve into or out of contact with its seat, and has a swiveling connection with said disk. The ordinary removable cup or plug is provided, in which the screw works, and an elastic or flexible sleeve of packing material is employed, loosely surrounding said screw and fitting outside the adjacent edges of said disk and said cap or plug, whereby leakage through said cap or plug is effectually prevented.

INTERLOCKING SWITCH-LEVER.

The switch stand is provided with a sliding plate having a diagonal lever-slot and a straight notched lever-slot supported upon transverse ribs on a fixed plate having parallel lever-slots, whereby the switch and signal-operating levers are interlocked.

ELECTRIC LAMP.

A late improvement in electric lamps comprises the novel arrangement of the following elements: In circuit with the carbons is a main magnet which tilts a lever carrying a train of gears, and thereby establishes the electric arc. A second magnet in the same circuit holds the train normally locked. A shunt around the second magnet is automatically closed and opened by a magnet in a high resistance branch around the arc, whereby said second magnet releases and locks the train of gears which regulate the arc.

RAILWAY CROSSING.

A novel crossing-plate has lugs and recesses for the reception and attachment of the rails, which abut against an intermediate block and are secured by ratcheted wedges and pins.

RAILWAY CAR-SPRINGS.

This improved car-spring consists of two or more volute spiral members, each of uniform thickness throughout its length, and having an edgewise taper from one end to the other. The said members are of different lengths, and concentrically coiled and unconnected with each other. This construction is adopted in order to obviate the difficulties which are experienced in spiral springs, in which the bar is uniform in cross-section throughout its length, and which do not settle uniformly when subjected to pressure.

NOVEL BORING-BAR.

The following are the essential features of late improvements in boring-bars: The bar or shaft has a transversely-slotted head and a segmental female screw-thread formed on one side of its slot or opening. A block or tool-holder is adapted to receive a shouldering or facing tool, and fits in a recess in the head of the bar. A feed-screw is fitted in a recess in the tool-holder and engages the female thread of the boring-bar. A stock is provided, fitting the socket in the feed-screw and serving to impart rotation thereto.

WASHINGTON, D. C. F. B. BROCK.

CORRESPONDENCE.

METER RATES.

EDITOR ENGINEERING NEWS:

I have for a long time thought that a reduction in the price of water furnished large consumers should be made, but not in the usual way—by placing an arbitrary rate per 100 cubic feet or 1,000 gals., thus:

10,000 gals. or less, per 1,000 gals.	$ .60
10,000 to 20,000 gals., per 1,000 gals.	.50
20,000 to 30,000 " " "	.40

As by this method there are points at which the consumer by *wasting* could actually save money, thus:

19,000 gals. @ 50c.	$9.50
21,000 " @ 40c.	8.40
2,000 " waste	$1.10

saved by consumer.

I give the above figures only from recollection, and the actual prices may not be correct; but the fact is.

The question, which is not a very deep one, is how to rectify this so as to give large consumers a reduction and at the same time not allow them to waste in order to save money.

If we assume the quantity of water used = Q, and if in cubic feet we use as the unit 100, or, if in gallons, 1,000, and X = the ratio; if the decrease of the cost be some power of $Q \pm n$,

Then we shall have $X = \frac{Q^n}{100}$

TABLES OF METER RATES.

$\frac{Q^{-.9}}{100}$ = Ratio, in which Q = cubic feet.

CUBIC FEET.	0	100	200	300	400	500	600	700	800	900
0	0.	1.0	1.9	2.7	3.5	4.3	5.0	5.7	6.5	7.2
1,000	7.9	8.6	9.4	10.1	10.7	11.4	12.1	12.8	13.5	14.1
2,000	14.8	15.5	16.2	16.8	17.5	18.1	18.8	19.4	20.1	20.7
3,000	21.4	22.0	22.6	23.3	24.9	24.5	25.2	25.8	26.4	27.0
4,000	27.7	28.3	28.9	29.5	30.2	30.8	31.4	32.0	32.6	33.2
5,000	33.8	34.4	35.0	35.6	36.2	36.8	37.4	38.0	38.6	39.2
6,000	39.8	40.4	41.0	41.6	42.2	42.8	43.4	44.0	44.6	45.2
7,000	45.9	46.4	47.0	47.6	48.1	48.7	49.3	49.9	50.4	51.0
8,000	51.6	52.2	52.8	53.4	53.9	54.5	55.1	55.7	56.2	56.8
9,000	57.4	58.0	58.5	59.1	59.7	60.2	60.8	61.4	62.0	62.5

CUBIC FEET	0	1,000	2,000	3,000	4,000
10,000	62.1	68.8	74.4	79.9	85.4
20,000	117.7	123.1	128.3	133.5	138.7
30,000	169.4	174.7	179.7	184.7	189.8
40,000	219.7	224.6	229.6	234.5	239.4
50,000	268.6	273.4	278.2	283.0	287.8
60,000	316.5	321.2	325.9	330.6	335.4
70,000	363.6	368.2	372.9	377.6	382.2
80,000	410.0	414.6	419.2	423.8	428.4
90,000	455.9	460.4	465.0	469.5	474.0
100,000	501.2	505.7	510.2	514.7	519.2
110,000	546.1	550.5	555.0	559.5	563.9
120,000	570.5	595.0	599.4	603.8	608.2
130,000	634.7				

CUBIC FEET.	5,000	6,000	7,000	8,000	9,000
10,000	90.9	96.3	101.7	107.1	112.5
20,000	143.9	149.1	154.3	159.3	164.5
30,000	194.8	199.8	204.8	209.8	214 8
40,000	244.2	249.1	254.0	258.9	263.7
50,000	292 6	297.4	302.2	307.0	311.7
60,000	340.1	344.8	349.5	354.2	358.9
70,000	386.9	391.5	396.1	400.7	405.4
80,000	433.0	437.6	442.1	446.7	451.3
90,000	478.6	483.1	487.6	492.1	496.7
100,000	523.7	528.2	532.6	537.1	541.6
110,000	568.4	572.8	577.2	581.7	586.1
120,000	612.6	617.1	621.5	625.9	630.3

In the tables you have I have assumed $n = 0.9$, and then $X = \frac{Q^{0.9}}{100} =$ the ratio of cost.

Now, to make the rates correct, the parties in power should fix some rate for 100 cubic feet, and the whole formula would be $\frac{Q^{0.9}}{100} R = c =$ cost for Q feet.

Take, for example, 100 cubic feet = unit used. Then for 100 cubic feet $X = 1$, and for 1,000 cubic feet $X = 8.6$ instead of 10, and for 2,000 $X = 15.5$ instead of 20, and if $R = 40$ cents

for 100 cubic feet $c = .40$
" 1,000 cubic feet $c = 3.44$
" 2,000 cubic feet $c = 6.20$, etc.

ENGINEER.

THE METRIC MEASUREMENT OF LUMBER AND FIRE-WOOD.

BOSTON, April 6, 1882.

EDITOR ENGINEERING NEWS:

The following explanation of the metric method of measuring wood, part of which originally appeared in the "Bulletin of the American Metric Bureau," for June, 1879, will be an appropriate conclusion to this series of articles upon the practical implements and methods of the metric system.

THE MEASUREMENT OF LUMBER.

"Lumber measure has been a stumbling-block to many students of the metric system. Nothing was said on the subject by any of the books, and no one seemed to know how to measure lumber metrically. The Bureau appointed Prof. William Watson, late of the Mass. Institute of Technology, and C. H. Swan, C. E., of the City Engineer's Office, Providence, to investigate this matter thoroughly, and report the best method. The plan submitted will commend itself to every reader.

REPORT OF THE COMMITTEE.

"The committee to whom was referred the metric measurement of lumber have attended to their duty to the best of their ability, and respectfully present the following report:

"The present system of board measures expressed in metric units would be an anomaly, and the committee do not see any reason for departing from the system of lumber measurement adopted by all countries using the metric system.

"The unit of measurement is the cubic meter or stere, to which the price is annexed. The cubic meter or stere being divided into 1,000 cubic decimeters or millisteres, a cubic decimeter or millistere is the smallest quantity usually considered (the cubic decimeter being about four-ninths of a foot, board measure, which contains 144 cubic inches, or one-twelfth of a cubic foot).

"The dimensions of the piece of lumber being taken in centimeters and multiplied together, by pointing off six figures from the right we obtain the contents in cubic meters or steres. For ordinary lumber, the last three decimals are unnecessary and may be omitted.

"Surveyors of lumber would mark each board with an Arabic numeral denoting its cubic contents in cubic decimeters or millisteres.

"For the purpose of measurement and rapid computation, the committee have prepared a scale to be used by lumber surveyors, the drawing and description of which are hereto annexed."

PRACTICAL APPLICATIONS.

Lumber of all kinds may be measured by the following simple

RULE.—Measure in *centimeters* the length, breadth and thickness, and multiply the three dimensions together.

If the measurement is to be given in *cubic decimeters or millisteres*, as would be the case with small pieces of lumber, point off *three* figures from the right. The figures at the left of this point will give the number of *cubic decimeters or millisteres*. For ordinary lumber the figures at the right of the point are unnecessary and may be omitted.

If the measurement is to be given in *cubic meters or steres*, point off *six* figures from the right. The figures at the left of this point will give the number of *cubic meters or steres;* those at the right of the point will give decimals of the cubic meter or stere.

The dimensions of merchantable lumber were undoubtedly determined, in the first instance, by the conditions governing the strength and stability of buildings; the most convenient dimensions in *inches* meeting these conditions, being those adopted in practice.

One of the results following the complete adoption of the metric system will be that the most convenient dimensions in *centimeters*, meeting the same conditions of strength and stability, which are independent of the system of measurement employed, will then be adopted for the sizes of lumber. This will necessarily simplify the work of metric measurement. The variations found in lumber of any nominal size are, in many instances, greater than the differences between such metric dimensions and those now in use.

Much time may be saved by using either of the following modifications of the above rule when measuring lumber of *regular* form.

Pieces of regular *breadth and thickness*, but of varying lengths, such as timbers and joists, can be quickly measured by means of a table giving the cubic measurements of different lengths of each size of merchantable lumber. Knowing the length of a piece, its cubic measurement can be taken directly from the table. A more compact but less convenient table could be made, giving the cubic measurement of *one meter* in length of each size of lumber. Such a table would require one multiplication for each measurement.

Pieces of regular *thickness*, but of varying breadth and length, such as boards and planks, can be easily measured by means of a *metric square-measure rule*, similar in character to those now used by surveyors of lumber.

This rule gives the area of boards, etc., varying in length from 3 meters to seven meters, and in width up to one meter, in *tenths of a square meter*. The area given by the rule, when multiplied by the thickness in *centimeters*, gives the cubic measurement in *cubic decimeters or millisteres*. This rule is used precisely as the ordinary board-measure rules are use.

The length of the board being measured in meters, the rule is laid across the board with its brass shoulder against the left-hand edge. At the point where the right-hand edge of the board crosses it, the area is read upon the line of divisions corresponding to the length of the board.

A small reference table containing the ordinary multiples of the numbers on the rule, could be conveniently used to avoid computing each amount. Such a table would comprise the numbers from 1 to 70, with their multiplies corresponding to the thicknesses, in centimeters, commonly used for the various kinds of lumber.

The *metric square measure* rule is not simply a board-measure, but it is a metric rule for mechanical quadrature, and has many applications outside the lumber business.

A *cubic measure* rule specially adapted to the measurement of lumber of some specific thickness, giving the volume directly in cubic decimeters or millisteres, and avoiding all multiplication, could be made and would be simple in character. It would, however, avoid multiplication only in the particular case to which it is adapted.

When metric dimensions shall have been adopted for lumber, boards 2.5 centimeters thick will constitute the largest part of the lumber commonly used.

The measurement of lumber will then be much facilitated by the use of a special cubic measure rule, adapted to a thickness of 2.5 centimeters. It may be used to measure lumber of other thicknesses by multiplying its results by a suitable factor obtained by the formula

$$0.4t,$$

in which t is the thickness in centimeters.

A small reference table comprising the numbers from 1 to 175 with their multiples corresponding to the thicknesses used, could be conveniently employed to avoid computing each amount.

The square measure rule is more simple in principle, and its factors are usually more convenient than those required for the cubic measure rule. On the other hand, the latter will avoid multiplication entirely in the majority of cases.

A consideration of the method of marking the measurement upon the lumber does not strictly belong to a discussion of the application of metric methods. Some modification of the present practice, which is adapted to another system, will doubtless be necessary.

A marking in Arabic numerals would require the least number of characters, and being distinct from the present method, would always indicate the kind of unit employed in the measurement of each individual piece.

The metric unit for measuring small pieces of lumber, the *cubic decimeter* or *millistere*, may be easily kept in mind, it being *one-tenth of a square meter, one centimeter thick.*

THE MEASUREMENT OF FIRE-WOOD.

The metric measurement of fire-wood is extremely simple. The wood being neatly and compactly piled, the three dimensions of the pile are measured in *meters and decimals* and multiplied together. The product is the volume of the pile in *cubic meters* or *steres*. The decimals to the right of the first or second place are unnecessary and may be omitted.

Besides measuring the total volume of a pile by the above method, the wood merchant has frequent occasion to measure specific volumes of wood. For this purpose a *measuring-frame* is used.

A measuring-frame consists of two stout uprights, strongly framed into a horizontal sill, which extends beyond them on either hand, and receives the lower ends of two inclined braces, which are framed into the uprights and sill. The dimensions of a frame are determined by the principle that the volume measured by it is the product of the length to which the logs are cut, multiplied by the distance between the uprights and multiplied by their height. The length of the logs and the distance between the uprights being determined, their height is obtained by a simple calculation.

Metric measuring-frames are four in number. Their dimensions are given in the following table:

NAME OF THE MEASURE.	Its capacity in steres.	Distance between uprights.	HEIGHT OF THE UPRIGHTS.	
			For wood 1.22 meters (4 ft.) long.	For wood 1 meter long.
		Meters.	Meters.	Meters.
Half-dekastere	5.0	3.0	1.366	1.667
Double-stere	2.0	2.0	0.820	1.000
Stere	1.0	1.0	0.820	1 000
Half-stere	0.5	0.5	0.820	1.000

The uprights of the *stere* and *half-stere* frames being divided into *ten* and *five* equal parts, respectively, each division is equivalent to one *decistere* of volume.

It is not necessary to consider the *centisteres* in the measurement of fire-wood.

In the forest it is convenient to arrange wood in piles of one or two *dekasteres* each.

THE MEASURES OF SOLIDITY.

The metric system provides two classes of measures of volume, or solidity.

The first, and more general class, consists of the cubes of the linear measures. The several denominations of this series increase by thousands, and each requires three places in which to write its units.

The second and more special class consists of the *stere* and its derivatives. The several denominations of this series increase by tens and require but one place.

Authorities agree in limiting the use of the *stere* to the measurement of *wood*. The best authorities restrict it to the measurement of fire-wood, and use no denomination smaller than the *decistere*. A few permit its use in the measurement of *round and square timber*, and recognize the *centistere*.

Should the *stere* and its derivative denominations be used in the measurement of *lumber and boards*, the *millistere*, equivalent to the cubic decimeter, will be necessary.

The complete table of measures of solidity would then be as follows:

Millistere	ma. =	1 cubic decimeter.
Centistere	ca. =	10 cubic decimeters.
Decistere	ds. =	100 cubic decimeters.
Stere	s. =	1 cubic meter.
Dekastere	dks. =	10 cubic meters.

CONVERSION TABLES.

One foot, board-measure = 2.3596 millisteres.
One millistere = 0.4238 ft. B. M.

One cubic ft. = 2.8315 centisteres.
One centistere = 0.35317 cubic ft.

One cord ft. = 4.5304 decisteres.
One decistere = 0.22073 cord ft.

One cubic yd. = 0.76451 cubic meters.
One cubic meter = 1.30802 cubic yd.

One round ton = 1.1326 steres.
One stere = 0.88291 round ton.

One hewn ton = 1.4158 steres.
One stere = 0.70333 hewn ton.

One cord = 3.6244 steres.
One stere = 0.27591 cord.

CHARLES H. SWAN, C. E.,
Chairman Committee on Manufactures American Metric Bureau.

NEW YORK, CHICAGO & ST. LOUIS.—Track is now laid from Hammond, Ind., east to beyond Vermillion, O., 285.37 miles, the gap between Hammond and Ft. Wayne having been closed. Track is also laid east of Erie, Pa., to a point 101.02 miles from Cleveland; east from Brocton, N. Y., 9.50 miles, and west from Hammond, Ind., 0.50 mile. This makes 396.29 miles laid in all, an increase of 21.25 miles since our last statement. These 21¼ miles were laid in nine working days, being over 2 miles a day. The same rate of progress is now kept up, and it is expected that by April 15 over 400 miles of the track will be down, leaving about 120 miles to be laid.

ENGINEERING NEWS.

GEO. H. FROST.....PROPRIETOR.

Tribune Building, New York City.

JULIUS W. ADAMS, *Past President A. S. C. E.*, EDITOR.

S. D. V. BURR. .....ASSOCIATE EDITOR.

SATURDAY, APRIL 15, 1882.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

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Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

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A BUILDING MATERIAL EXCHANGE has been organized in this city, mostly by former members of the Mechanics' and Traders' Exchange. Rooms have been taken at No. 12 Dey street, and the Exchange will begin business about May 1.

SANITARY.—We call attention to some experiments in the removal of house sewage in another column, under the head of "An Automatic Vault Cleaner." The experiments have been conducted, we are told, with marked success for several years. If the repetition of these experiments here should tend to verify the results attained abroad, it would go a long way to solve the question of the proper method of providing for house drainage without the threatened dangers attending the introduction of sewer gas.

THE METRIC SYSTEM.—The series of papers by Mr. C. H. Swan, on the metric system, of which the concluding one is published this week, are unlike the ordinary writings about the metric system, which treat mostly of the derivation and nomenclature, or are mere controversial effusions. These, on the contrary, treat of its implements and practical applications, and speak of it as a perfected system, ready for immediate use. We do not know of any papers now published in this country, or perhaps in the English language, that are so complete as they are, yet they are based upon the official school books of the French *primary* and *secondary* schools. Our school books are beginning to show the system, though very incompletely.

PERMANENT ROADWAYS.—George D. Ansley, Mem. A. S. C. E., City Surveyor of Montreal, Can., has just submitted a very valuable report on "Permanent Roadway Pavements" for that city, to the Road Committee. The report has been printed and forms a neat octavo pamphlet of 18 pages, in which is embodied much that is valuable to every city engineer. Mr. Ansley, after specifying the desirable features of a good pavement, describes the various kinds of pavements, as asphalt, which he classes as "front rank," compressed asphaltic blocks, Pelletier, mastic, wooden block, cobblestone, block stone, macadam, and he closes with his recommendations for Montreal, with a few notes on repairs and maintenance and some "general remarks." To parties interested in pavements this pamphlet is of value. It can probably be had by addressing Mr. Ansley, City Surveyor's Office, Montreal.

BRIDGMAN'S NEW MAP.—There are so many features to commend this map that we refer our readers to the prospectus which we publish elsewhere, and which will fully explain itself. It is on a scale of five miles to the inch. The lettering is bold and distinct. In the free spaces are given the whole of Long Island, at scale, a ward map of New York City, a map of the United States, and various tables of statistics—population, Congressional districts, railroad distances, post-offices, express companies, etc. As railroads in process of building (like the West Side and the New York, Lackawanna & Western) are represented as complete, the map in this respect will be less out of date a year or two hence than now.

A NATIONAL MINING and Industrial Exposition is to be held at Denver, Colorado, commencing August 1 and continuing to September 30. The President is ex-Governor H. A. W. Tabor, and H. D. Perky is General Manager. The Exposition Co. have published a circular pamphlet in which the programme, etc., is fully given. The object of the exposition is "To bring capital face to face with these opportunities for investment, and with skilled labor; to more rapidly develop the country, is an aim and purpose of the Exposition, and the display now in preparation is designed especially to hasten the establishment of extensive and flourishing industrial communities."

Any information required by firms or individuals desiring to participate in the Exposition will be promptly furnished by S. T. Armstrong, Secretary, Denver, Colo.

TESTS OF STRUCTURAL MATERIALS.

A synopsis of the proceedings of the Institute of Mining Engineers was published in No. 8 of ENGINEERING NEWS, Feb. 25, and the valuable papers read on the occasion were given by their titles. The published proceedings now before us are too voluminous for our pages, but a subject of great interest to engineers—the testing of materials of construction—was prominently brought forward and treated very ably from the different standpoints of individual members of the convention, and the purpose aimed at in these papers would be well conserved by spreading them before our readers, were it possible to do so. For the benefit of such of our readers as having decided views on the subject, may aid in furthering the pending legislation, which is alone needed to insure a practical result of great and growing interest to the public at large, as well as constructing engineers, we would state that Gen. J. M. Campbell, the Chairman of the House Committee on Manufactures, has expressed his more than willingness to receive the views of individuals, either in writing or personally before the Committee, in reference to the bill which he has introduced, and we trust that the profession generally will be found ready to respond to his wishes. The following is the text of the House bill referred to, and numbered H. R. 4,726, read twice and referred to this Committee.

A BILL authorizing the President to appoint a commission of experts, skilled in the investigation, production and use of metallic substances and other structural materials, to execute tests and experiments on iron, steel and other materials used in the construction of bridges, buildings and mechanical structures, and deduce useful rules therefrom.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

SEC. 1. That the President of the United States be and he is hereby authorized to appoint a commission of seven members selected from among men skilled in the investigation, production and use of metallic substances and other structural materials, to hold their appointment during the pleasure of the President of the United States; which commission shall plan and superintend the execution of such tests and investigations of materials used extensively in the construction of buildings, bridges, ships and other structures and machinery, as it shall think most important to be made, and from time to time publish results of the tests and investigations, and also such scientific principles and such practical rules deduced therefrom as it shall consider most useful. The said commission shall organize itself, and adopt such rules, and make such assignment of duties among its members as it shall deem most promotive of the object of its appointment. Vacancies occurring from time to time in said commission shall be filled by the President of the United States.

SEC. 2. That the said commission shall report its work, with its results and the deductions made therefrom, annually to the Secretary of the Interior, and its accounts shall be settled in the Interior Department, through such channels as the Secretary shall direct.

SEC. 3. That the members of said commission shall be entitled to mileage and other necessary expenses incurred in the prosecution of their duties, but no salaries as members of the commission.

SEC. 4. That the said commission is hereby authorized to appoint a principal expert, who shall personally conduct the examinations and tests which the commission shall direct, with such assistants and laborers as may be necessary, and also to purchase such material for test and investigation as may from time to time be required.

SEC. 5. That this act shall take effect immediately.

We believe that the initiative in this direction was taken at a convention of the American Society of Civil Engineers, held in Chicago in June, 1873, on motion of Gen. W. Sooy Smith, to appoint a committee of that Society to memorialize Congress on the subject, and which resulted in the passage of a law in March, 1875, for the appointment of a "United States Board to test Iron and Steel," with an appropriation of $75,000 to carry out the object of the bill. The first duty of the Board was of course to perfect a machine on such a scale as to grapple with the full dimensions of the material then in use, and at the same time of such delicacy of construction as to reduce the errors of the machine itself to an insignificant fraction. There was no precedent for such a machine, and in consequence the cost of erecting one could not be foreseen. Fortunately there was no question of the kind of machine to be built, and to Mr. A. H. Emery's genius we are indebted for the result in a machine which is pronounced by all who are entitled to an opinion on the subject as a marvel of mechanical genius and skill—unapproachable by anything in existence of the same purport.

The appropriation was thus exhausted, and an effort was made in 1876 to secure further appropriations to carry on the work, under what embarrassments may be judged of by the remark of the Chairman of the Appropriation Committee of the House to an engineer seeking information: "Can you tell me how many Democrats there are on that Board?" The final result was a small appropriation and legislating the Board out of existence; the testing machine being remanded to the custody of the Ordnance Department, U. S. Arsenal, Watertown, but accessible for private use under a system of fees.

At the convention of the Institute of Mining Engineers in February last, the discussion on this subject of reappointing a U. S. Commission to test materials was briefly opened by Mr. Ashbel Welch, President of the A. S. C. E., and followed by Mr. Charles Macdonald, of the same society. Upon reading the latter paper, we concluded that the whole ground had been covered, and nothing further remained to be said; but so far from this proving the fact, every member of the Institute who spoke upon the subject brought either new light, or, seen from a different standpoint, presented such additional and cogent reasons for the necessity of such Government commission, that it is difficult, in justice to the speakers, to quote from them briefly in the limited space at our command; and without disparaging the value of the remarks of Gen. Meigs, Capt. Lyle, E. D. Leavitt, Jr., T. C. Clarke, O. Chanute, Dr. Egleston, G. S. Morison, Percival Roberts, Jr., and Wm. Metcalf, all of whom contributed of their experience to the elucidation of the subject, we must confine ourselves to some selections from Mr. A. P. Boller's most able and exhaustive paper, which, in addition to exhibiting the scope of the proposed investigation, embraces his own views as to the composition of such a Board, and the method of its appointment and the direction of its responsibility, so entirely in accordance with our own views on the subject that we offer no apology for endeavoring to emphasize them. The divisions of the proposed work as arranged by Prof. Thurston were as follows:

ON ABRASION AND WEAR. *Instructions:* To examine and report upon the abrasion and wear of railway wheels, axles, rails and other materials, under the conditions of actual use.

ON ARMOR PLATE. *Instructions:* To make tests of armor plate, and to collect data derived from experiments already made, to determine the characteristics of metal suitable for such use.

ON CHEMICAL RESEARCH. *Instructions:* To plan and conduct investigations of the mutual relations of the chemical and mechanical properties of metals.

ON CHAINS AND WIRE ROPES. *Instructions:* To determine the character of iron best adapted for chain cables, the best form and proportions of link, and the qualities of metal used in the manufacture of iron and steel wire rope.

ON CORROSION OF METALS. *Instructions:* To investigate the subject of the corrosion of metals under the conditions of actual use.

ON THE EFFECTS OF TEMPERATURE. *Instructions:* To investigate the effects of variations of temperature upon the strength and other qualities of iron, steel and other metals.

ON GIRDERS AND COLUMNS. *Instructions:* To arrange and conduct experiments to determine the laws of resistance of beams, girders and columns to change of form and to fracture.

ON IRON, MALLEABLE. *Instructions:* To examine and report upon the mechanical and physical properties of wrought iron.

ON IRON, CAST. *Instructions:* To consider and report upon the mechanical and physical properties of cast iron.

ON METALLIC ALLOYS. *Instructions:* To assume charge of a series of experiments on the characteristics of alloys, and an investigation of the laws of combination.

ON ORTHOGONAL SIMULTANEOUS STRAINS. *Instructions:* To plan and conduct a series of experiments on simultaneous orthogonal strains, with a view to the determination of laws.

ON PHYSICAL PHENOMENA. *Instructions:* To make a special investigation of the physical phenomena accompanying the distortion and rupture of materials.

ON REHEATING AND REROLLING. *Instructions:* To observe and to experiment upon the effects of reheating, rerolling, or otherwise reworking; of hammering, as compared with rolling and of annealing the metals.

ON STEELS PRODUCED BY MODERN PROCESSES. *Instructions:* To investigate the constitution and characteristics of steel by the Bessemer, open hearth and other modern methods.

ON STEELL FOR TOOLS. *Instructions:* To determine the constitution and characteristics, and the special adaptations of steels used for tools.

What is wanted now is a more comprehensive law for the proposed new board than the one creating the old, and one fully recognizing the national character of the work. To this end the powers of the board should be fully defined, and all necessary provision made for its successful operation. Such a board should not be tacked on in any way to an army department, but should be an independent creation, reporting to the Secretary of the Treasury or the Secretary of the Interior. The work is almost entirely civil work, just as much as that of the Coast Survey, and should remain in existence as long as there is a metallic question, so to speak, remaining unanswered. Now that the testing machine is an accomplished fact, the board could profitably spend $50,000 per annum in experimenting, and the center of its operations should be in the city of Washington, to which point the testing machine should be removed from Watertown Arsenal, its present abiding place. The operations of the board should be reported in a yearly volume, such volume being readily obtainable by the scientific men and metal workers of the country, either by sale for the mere cost of publication, or a proper system of distribution, whereby the object of its publication would be accomplished. There is a tradition that an edition was published of the only report made to Congress by the old board, which, if true, has most successfully failed to reach the very class of men who could profit by it, leading to a vague suspicion that its distribution was based on political and not scientific methods. If it is not possible, under the existing methods of distributing public documents, to give the board absolute charge of distributing the yearly reports of their own work (and who, in the name of common sense, can better judge of where they should go), then the manner of distribution should be defined by the law creating the board. Too much attention cannot be paid to this branch of the board's work, since the very object of its creation would be defeated if the results of its work were not only accessible, but conveniently so, to all seeking such information.

We are now brought to the consideration of rather a delicate question, about which there are differing views, and that is the remuneration, if any, of the men engaged in the work of the board. This work, if properly followed up, would be an exceedingly engrossing one, calling for a practical abandonment for the time being of any other pursuit, and it would seem manifestly unfair to demand that such labor and sacrifice should be unrecompensed. Again, the great majority of men qualified for such work (and there are not many such available) would be deterred from accepting service on the board, to whose work they would otherwise bring great enthusiasm and attainment, from sheer financial inability to perform unrecompensed labor. Whatever is worth doing is worth doing well, and to expect qualified men to do thoroughly the work called for by such a board as is proposed, unrecompensed—a work, too, that will so richly compensate the American people—is expecting a degree of self-sacrifice that should not be looked for this side of Utopia, and should not be asked for. The only objection possible to urge against a paid board, all or in part, is the one usually attaching to government salaried positions or appointments, and the possibility, therefore, of unworthy or incompetent appointments. In other words, that the board would get into politics, and that the question of the chairman of the House Appropriation Committee, before related, would be asked with redoubled earnestness. Be this as it may, it should be thoroughly understood that the moment the proposed board takes on a political bias, its usefulness is ended. Its aim is purely a scientific one for practical ends, and as such must be established on its merits alone, and if this view is not prominently kept in the foreground, and made the basis of all legislation concerning it, the whole matter had better be dropped. We must not be impatient for results, but ever bear in mind that the questions asked by the modern engineer are exceedingly complex ones, and that, while he would have been content a few years back to know the amount of strain an iron bar, for instance, would stand before rupture, he demands now to know the reasons that cause different bars to yield different results, or the same bar to yield different results under varying treatment; or why a small bar should behave differently from a large bar of the same material. All such answers require a long series of experiments, and the gathering of information from actual experience, besides chemical examinations hitherto deemed unimportant; and in regard to steel, all that is known is so little compared to what is yet to be learned about its properties and adaptations, that the field of research is almost appalling in its magnitude and intricacy.

EADS' SHIP RAILWAY.

Inquiry is made as to the present status of this enterprise, and much misapprehension, if not ignorance, is shown as to the merits of the case, and the extent of the guarantee which the government is called upon to exercise. To meet this we cannot do better than to give some extracts from the Report of the Senate Committee, to whom was referred the bill (No. 430) to incorporate the Interoceanic Ship Railway Company.

After referring to expert testimony submitted to the committee from a great number of distinguished engineers and contractors, and others who are cognizant with works as nearly similar as at present exist in the world, bearing evidence to the entire practicability of a ship railway of the kind designed, and in the locality named, the committee refer to the report of a special committee of the House of Representatives of the Forty-sixth Congress, who were charged with the duty of considering all questions relating to isthmean transit, and who, in the exercise of their duty, not only reported in favor of the Tehuantepec as the most preferable route, but in favor of Captain Eads' ship railway, and quote from the report of the special committee of the House, as follows:

"In the opinion of your committee, it would be a great mistake for the government of the United States to fail to reeognize, in a substantial way, the overtures thus made by Mexico. The duty of our government in the premises is a plain one, whether viewed from a selfish or an unselfish standpoint. If viewed in the former light, it must be apparent to any one at all familiar with the enormous commercial interests which will be affected by the great work proposed that any liberality exercised by our government will be returned a hundred fold in the increased benefits resulting to our commerce. Of the valuable and growing commerce of Mexico, the United States now enjoys but 5 per cent.; 95 per cent. of it is enjoyed by other nations. The markets of Mexico are to-day practically closed to the products of our soil and industry, while there is no good reason why they should not be open to both.

"The combined commerce of British India, Australia, China, Hong-Kong, Peru, New Zealand, Chili, Japan, the Philipine Islands, Tasmania, and the Hawaian Islands amounts to $1,425,953,000 annually. Of this vast commerce the United States only enjoys 4 per cent., and the Mississippi Valley, comprising a territory equal in extent to six-tenths of the total area of the thirty-eight States of the Union, is wholly debarred therefrom. An increase of our trade, nearly doubling it in this quarter, would more than compensate the United States for the guarantee asked by Mr. Eads.

"Leaving out of view the question of interest, it would scarc ly be consistent with the dignity and magnanimity of as great a country as ours to reject the friendly proffers of a sister republic, and refuse to lend any assistance to a great work like that proposed; especially so in view of the revived fraternal feeling now existing there towards us."

And then proceed to say, that—"The concession which Mr. Eads has secured from the government of Mexico, which was first granted by the executive, and subsequently ratified by the Mexican Congress, is cetainly a most liberal one. It gives to Mr. Eads a right of way across the isthmus half-a-mile in width, with an increased width at stations. It exempts the company and its property from all taxation, general or local, during the period covered by the grant, namely, 99 years. It gives to the company the right to import upon the isthmus, during the same period, all materials necessary for the construction and operation of its railway. It exempts the company from export duty on silver and bullion used by it either in the payment of dividends or of debts contracted abroad, and it makes a donation to the company of a million acres of public land.

"Mr. Eads does not ask the government of the United States to advance any money to construct the railway, but merely asks, and the bill provides, that the government shall guarantee the payment for the period of fifteen years of dividends at 6 per cent. per annum upon the par value of $50,000,000 of the capital stock of the company. It is estimated that the cost of constructing the work will be about $75,000,000, and the capital stock is limited by the bill to this amount. The guarantee of the government only attaches to the extent of two-thirds of this capital stock. The bill provides that the guarantee shall not attach or have any force or effect until ten miles of the railway, and its terminal works, shall have been constructed and a loaded vessel shall have been lifted out of the water, transported over such ten miles of railway, brought back again, and again placed in the water without injury to the vessel, the railway, or the terminal works. When this has been accomplished $5,000,000 of the guarantee shall attach. When the terminal works, and ten miles of railway shall have been constructed upon the other side of the isthmus, and shall have been tested in the same manner, $5,000,000 more of the guarantee shall attach.

"The intermediate space between the two ten-mile sections is subdivided into twenty sections; upon the completion of each of these sections, and the successful transportation over it of a loaded vessel, proportionate amounts of the guarantee respectively attach, until the total amount of $50,000,000 is reached. All of these tests are required by the bill to be made in the presence of a board of engineers, to be appointed by the President of the United States.

"The committee do not consider it necessary to go into a discussion of the various provisions of the bill reported herewith. This bill has been carefully considered, and the committee are of opinion that under its provisions the government of the United States is amply protected against any ultimate loss by reason of its guarantee, and the government aid provided for is the least which our government could hope to give with a view of securing the construction and control of an isthmean highway.

"The consideration for the guarantee the committee believe to be most ample and satisfactory. The company is required by the bill to transport upon its railway, during the whole period covered by the Mexican concession, all government vessels, troops, munitions of war and mails free of charge; and it is further required during the like period to transport upon its railway all vessels belonging to citizens of the United States and registered under the laws of the United States for fifty per centum of the regular tolls and charges imposed for the transportation of vessels belonging to the citizens of any other country except Mexico. It requires no argument to show the immense advantage which this latter provision will secure to American shipping."

"The construction of the ship railway at Tehuantepec is a final solution, in the opinion of the committee, of the much-discussed question of isthmean control. If this railway be once constructed under the patronage of the U. S. government, it will supply the present demands of commerce, and will place the United States in such relation in regard to isthmean transit and its cognate political relations as will make it simply impossible for any foreign power to hereafter control any other transit across our isthmus; but if we refuse to lend assistance to a project, the successful consummation of which is now demanded by the commerce of the world, we invite foreign capital to embark in the enterprise, and the investment of foreign capital means the protection of foreign power.

"The committee do not consider that our government would be safe in permitting Mr. Eads to even organize an American company without government aid, because, upon the organization of such company, its stock would necessarily be exposed publicly for sale. It could be easily bought up by British capitalists; and a British board of directors, having invoked and secured the aid of their own government, could place us in the very position which we now seek to avoid. Should the government of the United States, however, give the desired aid, she will at once acquire certain vested rights from which she cannot be dispossessed.

"The Mexican concession only authorizes Mr. Eads or the company to obtain aid from one foreign government. Having obtained such aid, they have done all they had a right to do in the premises and no other government could acquire any rights whatever.

"The completion of the line of railroad from California to New Orleans has excited the alarm of the British capitalists whose ships have been carrying around Cape Horn grain from California to Liverpool. This railroad will be able to carry the grain to New Orleans, ship it through the jetties at the mouth of the Mississippi River and deliver it in Liverpool 80 or 90 days sooner than the English ships. The immense capital invested in the several hundred English vessels, and the lucrative character of the trade in which they are engaged, indicate too surely that such trade would not be readily abandoned or surrendered. The railroad companies have it in their power to so reduce their freight charges for carrying grain as to render competition upon the part of these English ships almost impossible, and having thus destroyed

this competition would then be enabled to increase their freight charges to the highest rates the producers could bear. That they would so do is evidenced by the course which they have adopted under such circumstances.

"The owners of these English vessels have but one source to look to for relief, and that is a transit-way across the isthmus, by using which, the voyages of their vessels would be shortened by seven or eight thousand miles. It is idle to suppose that they will hesitate for a moment in promptly raising the capital necessary to construct the ship railway should the United States government decline to take control of it.

"Believing that the commercial interests of this country will be largely benefited by the construction of the ship railway, that it will have a tendency to infuse new life into our now languishing commerce, and that it is essential if our government would retain the respect of its own people and of foreign nations, that it should now practically demonstrate its determination to forever discourage foreign control upon this continent, the committee report back the bill favorably, with certain amendments, and with the recommendation that it do pass."

PROPOSED WATER-WORKS FOR CAMBRIDGE, MASS.

There is now before the Massachusetts Legislature a bill in which the City of Cambridge asks to be permitted to take an additional supply of water from the Shawsheen River, a stream of excellent pure water, which rises in the town of Lexington, and flows in a northerly direction through the towns of Lexington, Bedford, Billerica, Tewksbury and Andover, and empties into the Merrimack River near the city of Lawrence. The surveys, plans and estimates which have been prepared by the City Engineer of Cambridge, Wm. S. Barbour, C. E., Member of the American Society of Civil Engineers, show that at the point on the stream near the old Middlesex Canal, where it is proposed to take the water, in the town of Billerica, the minimum yield of river with the proper storage basins, is 20½ millions of gallons daily; the drainage area above this point is 34 square miles. The works contemplated are the construction of a dam across the valley near the old canal, 1,600 ft. long and 25 to 30 ft. high above the stream, thus creating a storage reservoir covering some 800 acres, and capable of holding about 2,000,000,000 gallons of water. The bill asks for permission to take a quantity not exceeding 8,000,000 gallons daily, and it is proposed to conduct the water by means of a suitable sized iron pipe, laid for the most part of the way in the bed of the old Middlesex Canal(abandoned many years ago). This forms a very direct and favorable route to Fresh Pond, the present source of supply of Cambridge. Here the water can be delivered into the pond, to be used as a storage reservoir, or directly to the pumps, which supply the consumption of the city, the elevation of the stream not being sufficient to supply the consumption direct.

The estimated cost of these works (exclusive of mill damages on the stream below the point of taking), is $700,000. The City of Boston also desires to take a portion of the Shawsheen for the Mystic supply, and is not opposed by Cambridge. Should the bills be granted to each, a more expensive scheme of works would probably be carried out with proportionate smaller cost of each.

There is also now in process of construction a separate system of high service supply for Cambridge. The work embraced in this plan is the erection of a 1,000,000 gallon pumping engine of the Worthington make, at the present pumping station, the laying of a new force main about ½ mile in length from the station to the present stand-pipe, a portion of which is to be used for the new supply; the laying of about 1½ miles of new supply mains to the more elevated portions of the city, which it is designed to supply, and includes those portions which are above grade 60. The old mains are separated from the new by check valves and gates at the proper points so that the old method of supply is not interfered with in the new. The plans for this work have been prepared by the City Engineer, and the work of construction is being done by the Superintendent of the Cambridge Water-Works, Hiram Nevons, Esq. Cost is estimated at about $10,000.

THE DENVER SOCIETY OF CIVIL ENGINEERS.

This, the latest engineering association, was organized Feb. 7 last. Its officers are John Pierce, President; Robert B. Stanton, Vice-President; Ed. H. Kellogg, Secretary and Treasurer; Arthur I. Fonda, Corresponding Secretary and Librarian. There is also an Executive Committee, composed of E. S. Nettleton, P. H. Van Diest and F. P. Swindler. The objects of the society are "the professional improvement of its members, the encouragement of social intercourse among men of practical science, the advancement of engineering in its several branches, and the establishment of a central point of reference and union for engineers in the Rocky Mountain region." To become a member "one must have been a civil, mining or mechanical engineer, in active practice as such for five years, or who has graduated as a civil engineer, been in practice for three years, and has had responsible charge of work as chief, resident or superintending engineer, for at least one year; not as a skillful workman merely, but as one qualified to design as well as to direct public work. The entrance fee is ten dollars. The society starts out with about twenty members, which includes the leading engineers in and about Denver. The constitution and by-laws are printed and can be had on application.

PERSONAL.

E. L. M. HOARE, Chief Engineer of the Chicago & Indianapolis Air Line, has, resigned and is succeeded by L. B. Jackson. H. A. Lovell, Assistant Chief Engineer, also resigned.

JOHN LENTHALL.—Naval Constructor John Lenthall, United States Navy (retired), died suddenly at the Baltimore & Ohio depot in Washington this morning, as he was about to take the train for New York. He was in his 75th year, and was placed on the retired list in 1871. His health has been failing for some time. He was Chief of the Bureau of Construction and Repairs for a number of years.

MAJOR M. F. HURD and Frank P. Davis, Civil Engineers on the Denver & Rio Grande Western Railway, have resigned and accepted positions on the Canadian Pacific, with headquarters at Fort Calvary.

OSCAR H. PEACOCK has been reappointed City Surveyor of the city of Rochester, N. Y.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

Continued from page 114.

CCLXV.—THE DALLES.

The Dalles, Oregon, in lat. 45° 36′ 18″ N., long. 121° 12′ 8″ W., is on the Columbia River at a point where it passes a cañon of basaltic rock, with a rapid descent. Settled in 1852, it was incorporated in 1858. Water-works were built in 1862 by Robert Pentland, taking the supply from a mountain stream of about 200 square miles watershed, in the Cascade Mountain range. A breakwater diverts water from the stream into a box conduit of 1½ in. fir plank, 8½ by 10-in. inside, which is laid underground and conveys the water 1¼ miles to two reservoirs, one a stone basin 16 by 18 ft. and 8 ft. deep, the other, a natural rock basin, 75 by 150 ft. and 2 ft. deep, at 90 ft. above the city. An 8-in. cast-iron main leads from the reservoir to the city, where the distribution is by 1½ miles of 4-in. cast-iron pipe, with 6 fire hydrants, 8 gates and 400 taps. The town pays $100 per year each for 6 hydrants and 6 cisterns. Wrought-iron service pipes are used.

The population is about 1,200 and the daily consumption is 600,000 gallons.

The works cost originally $10,000. The cost now is $37,000.

The expenses in 1880 were $3,000 and the receipts $7,800.

Since 1877 Samuel L. Brooks has been the Superintendent and half owner, Robert Pentland owning the other half of the works.

CCLXVI.—TRINIDAD.

Trinidad, Colorado, in lat 37° 12′ N., long. 104° 30′ W., on the Las Animas River, is on the foothills of the Raton range of mountains, about 6,000 ft. above sea level. It was first occupied by Americans in 1875, and was incorporated as a city in 1879, in which year water-works were built by Delos A. Chappel, as a private enterprise.

The supply is taken from a well 25 ft. in diameter and 16 ft. deep, connected with a conduit or filter gallery 3 by 2 ft., and 300 ft. long, the walls laid dry and covered with flat stones. The well and gallery are in clean, coarse, saturated gravel near the river.

Two Cope & Maxwell double-acting steam plunger pumps lift the water 310 ft. through a mile of 12-in. pipe, laid through the heart of the town to a reservoir on high table land, 250 ft. above the main street, built in excavation and embankment, with the bottom covered with concrete overlying puddle and the sides paved with flat stones with cemented joints. It holds 2,000,000 gallons.

Distribution is by cast-iron pipe of 12 to 4-in. diameter; 5¼ miles are laid, including the force main, which is also a distributing pipe. There are 33 fire hydrants, 25 gates and 265 taps; 150 meters are in use. The city pays $100 per year for each of 25 fire hydrants, and $70 each for additional ones. Wrought-iron service pipes are used, some of them cement-lined. The population is now 4,000 and the daily consumption 190.000 gallons. The works have cost $100,000. The expenses in 1881 were $6,000, and the receipts $10,000. There is no debt.

The works are owned by Delos A. Chappell. W. B. Cunningham is the General Superintendent.

CCLXVII.—BERWICK, PA.

Berwick, Pennsylvania, in lat. 41° 5′ N., long. 76° 15′ W., is on the North Branch of the Susquehanna River. It was settled in 1782, and incorporated as a borough about 1800.

Water-works were built by a private company in 1848, taking the supply from a spring on the river bank. A pump, driven by water-power from the canal in summer, and by a steam engine in winter, lifts the water 102 ft. into a small stone masonry reservoir. Distribution is by cast-iron pipe, of which about 2 miles are laid, with 2 fire hydrants and 300 taps. The borough does not pay for the use of hydrants. Lead and wrought-iron service pipes are used.

The population in 1880 was 2,094. The consumption is not known.

The capital stock of the company is $8,000. No other financial statements are given, except that there is no bonded debt.

S. B. Bowman is the Superintendent.

CCLXVIII.—BLOOMSBURG.

Bloomsburg, Pennsylvania, in lat. 41° 02′, long. 76° 28′, is on Fishing Creek, two miles above its junction with the Susquehanna River. The town is about one mile from this river. The country is level for a mile from the river. To the north and west it is then rolling, and to the south and east rocky and rough.

Settled in 1802 and then called Oystertown, it was incorporated as a town in 1870.

Water-works were built in 1880 by a private company, after the plans of Henry P. M. Birkinbine, C. E., taking its supply from Fishing Creek, which has its source in the North Mountain, a spur of the Alleghanies, thirty miles above the town.

Two 8-in. pipes conduct the water 50 ft. to the pump well whence it is lifted 180 ft. by two 6½-in. Birkinbine pumps driven by two 40 horse-power steam engines, arranged to work separately or together. For ordinary service, water is pumped into a reservoir built in excavation, 128 ft. in diameter at top, and lined with 18 in. of puddle. It contains 1,250,000 gallons, and is 154 ft. above the centre of the town. There are arrangements by which connection with the reservoir is cut off in case of fire and the pressure is raised to 125 lbs. to the square inch. When that pressure is exceeded, a safety valve discharges into the reservoir.

Distribution is by cast-iron pipe, 5½ miles of which, of from 10 to 4-in. diameter, are laid, with 42 fire hydrants, 20 gates and 175 taps. The town pays $1,200 per year for use of fire hydrants; service pipes are of galvanized iron.

The population in 1880 was 3,704. The daily consumption in 1881 was 46,925 gallons.

The capital stock of the company is $30.000. The works have cost $37,000. The bonded debt is $6,000 at 5 per cent interest.

The expenses and receipts are not given.

F. P. Bilmyer is the Secretary and Treasurer and E. Jabcoby the Superintendent.

CCLXIX.—PITTSTON.

Pittston, Pennsylvania, in lat. 41° 29′ N., long. 75° 47′ W., on the Susquehanna River, at the head of the Wyoming Valley, is on broken and hilly ground. The business part of the town lies along the river on low ground.

Settled before 1776, it grew slowly until the development of the coal fields in its vicinity. It was incorporated as a borough in 1853.

Water-works were built by a private company in 1855, taking the supply from the Susquehanna River, and pumping into reservoirs by a rotary pump, which was not successful in its operation.

A Worthington compound duplex steam engine of 2,000,000 gallons capacity, erected in 1877, and a Knowles double-acting plunger pump of 1,500,000 gallons capacity, erected in 1882, lift the water 166 ft. to a reservoir in excavation and embankment, holding 2,000,000 gallons, and 191 ft. to another reservoir holding 500,000 gallons.

Distribution from the reservoirs is by cast-iron pipe, of from 12-in. to 2-in. diameter, of which 15 miles are laid, with 27 fire hydrants in Pittston and 15 in West Pittston and 1,200 taps. Heretofore the borough has not paid for use of water, but a suit at law has just resulted in an order of court to pay $15 per year for each hydrant. Service pipes are principally of galvanized iron and some lead pipe.

The population supplied is 13,000 and the daily consumption 800.000 gallons.

The capital stock of the company is $76.350. The works have cost to the present time $166,593.50. There is a bonded debt of $14,000 at 6 per cent. interest. The expenses in 1880 were $6,000 and the receipts $17,000.

R. J. Wisner is President of the company. John

Anderson has been the Superintendent since organization.

A separate company was organized in West Pittston in 1871, to which water was furnished by an 8-in. pipe laid across the bed of the river. This company was purchased by the Pittston company in 1877.

CCLXX.—GENEVA.

Geneva, New York, in lat. 42° 52' N., long. 77° 9' W., at the foot of Seneca Lake, is in a gently rolling and very fertile region. Settled in 1787, it was incoporated as a village in 1806.

Water-works were built by a private corporation shortly after a charter was granted to it in 1797. The works were designed and built by W. S. Dezeug. The supply is taken from the "White Springs," and collected in two reservoirs, one 150 ft. square and 16 ft. deep. The other, 25 ft. lower, is 80 ft. in diameter and 7 ft. deep, and is 125 ft. above the lake and the lower part of the village. The distribution is by cast-iron pipes, of which 4 miles are laid, of from 10-in. to 4-in. diameter, with 24 fire hydrants and 300 taps. The village pays $60 per year for each hydrant. Service pipes are of iron. The population in 1880 was 5,861. The consumption is not given nor the cost of the works. There is a bonded debt of $35,000 at 6 per cent. interest. No further financial statements are furnished. A. L. Chew is the Secretary and Treasurer and S. S. Graves the Superintendent.

CCLXXI.—GREENWICH.

Greenwich, Connecticut, in lat. 40° 59' N., long. 73° 39' 4" W., is on Long Island Sound. The surrounding territory is rough and rocky. It was settled in 1611.

Water-works were built in 1880 by a private company, after plans and under the superintendence of William B. Rider, C. E.

The supply is procured by gravity from an impounding reservoir on a stream of 4 square miles water-shed, 4 miles from the town and about 280 ft. above its lower portion.

The water is filtered through charcoal in flumes, with satisfactory results. It is then conveyed through 4 miles of 12-in. cast-iron pipe, and distributed by 2½ miles of cast-iron pipe of 8 to 4-in. diameter, with 26 fire hydrants, 28 gates and 120 taps. The town pays $1,000 per annum for use of fire hydrants. Lead service pipes are used. The population in 1880 was 7,965.

The capital stock of the company is $100,000. The works have cost $84.000. There is no debt. Further financial statements are not given. G. G. McHall is Secretary of the company, and W. B. Rider the Engineer.

CCLXXII.—DANVERS.

Danvers, Massachusetts, in lat. 42° 40' N., long. 70° 57' W., on Porter's River, an arm of the sea, is on rolling ground, rising from the sea-level to an elevation of 250 ft. It was originally a part of Salem.

Water-works were built in 1876 for the town, after the plans of George H. Bishop, C. E., by George H. Norman.

The supply is taken from Middleton Pond, 5 miles from the town. Its area is 106 acres and its water-shed 3 square miles. It is about 90 ft. above sea-level. A Worthington duplex tank eng.ne of 2,000,000 gallons capacity, erected in 1876, and a duplicate of the same, erected in 1882, pump the water through a 12-in. wrought-iron and cement pipe 2.6 miles long to a reservoir on Hawthorne Hill, in the grounds of the State Insane Asylum, 230 ft. above sea-level, in excavation and embankment, and holding 5,000,000 gallons.

Distribution is by wrought-iron and cement pipe of from 12 to 4 in. in diameter. Twenty-nine and one-quarter miles are laid, 17 of which are of 4-in. diameter. There are 196 fire hydrants, 169 gates, 881 taps and 20 meters. The sum paid by the town annually, out of taxation, for deficiency in revenue, amounts to about $25 per hydrant. Service pipes are of 1 in. wrought iron, cement lined. The population in 1880 was 6,500 and the daily consumption, in 1881, 400,000 gallons, including water furnished to the Insane Asylum. The cost of construction had been to Jan. 1, 1882, $222.479.65. The State paid $12,500 of this and also pays $1,000 per annum for the Asylum supply. The gross receipts have been $66,140. The bonded debt is $205.000 at 4 and 5 per cent. interest.

The expenses in 1880 and 1881 were as follows:

	1880.	1881.
For maintenance	$3,990.04	$6,561.60
For interest	9,000.00	9,500.00
The receipts from water rents were	10,108.76	11,205.11

The works are managed by three Commissioners, one of whom is elected each year. Benjamin E. Newhall is the Superintendent.

CCLXXIII.—MOLINE.

Moline, Illinois, in lat. 41° 80' N., long. 90° 35' W., on the Mississippi River, is on bottom lands about half a mile wide and bluffs back of them 150 ft. high.

Settled in 1843, it was incorporated as a village in 1858 and as a city in 1872. Water-works were built in 1877 by the city, after plans of M. A. Gould, the City Engineer.

The supply is taken from a pool above a dam built by the U. S. Government from the Illinois shore to Rock Island. This dam is of stone, 4,000 ft. long, 20 ft. high, 8 ft. wide at bottom and 4 ft. at top, with buttresses. The water is drawn from the channel to a settling basin through a box conduit, 14 by 36 in., of 2-in. pine plank, and 1,000 ft. long. From the settling basin it was pumped by a Knowles pump erected in 1879. A Worthington duplex pump was substituted for it on Jan. 1, 1882. Water is pumped directly into the mains, with an ordinary pressure of 45 lbs. and a fire pressure of 100 lbs. An intermittent supply is furnished to some consumers on the bluffs. It is proposed to build a reservoir in 1882 on the bluffs 150 ft. above the river.

Distribution is by 2¼ miles of 8-in. and 6-in. cast-iron pipe, with 50 fire hydrants and 12 gates. The number of taps is not given. The pumps are furnished and run by a contractor in consideration of the payment by the city of $50 per year for each fire hydrant. The contractor also receives rentals from consumers.

The population in 1880 was 7,740 and the daily consumption 12,000 gallons in 1880 and 25,000 in 1882. Service pipes are of wrought iron.

The works cost $16,000, exclusive of the pumps. No further financial statements are given.

Some trouble has been experienced with anchor ice at the inlet.

The works are in charge of M. A. Gould, the City Engineer.

ACKNOWLEDGMENTS.—The receipt of statistics as follows, is acknowledged with thanks: From W. B. Cunningham, general superintendent, statistics and water rates of the water-works of Trinidad, Colorado. From R. W. Bagnell, superintendent, report of Plymouth, Mass., water commissioners for 1881. From John Anderson, superintendent, statistics and water rates of the water-works of Pittston, Pa. From W. B. Rider, C. E., statistics and water rates of the water-works of Greenwich, Conn. From Benjamin E. Newhall, superintendent, statistics and water rates of the water-works of Danvers, Mass., and reports of water board.

RAILWAY NECROLOGY FOR 1881.

LIST OF RAILWAY OFFICERS, FORMER OFFICERS, NOTED CONTRACTORS, ETC., WHO DIED LAST YEAR.

[From the Chicago Railway Age.]

JANUARY.

Charles R. Clement, general baggage agent of the Pennsylvania and Northern Central, died at Philadelphia.

General Charles B. Stewart, chief engineer of the Connotton Valley road, died at Cleveland, O., aged 67.

Benjamin Stevenson, formerly auditor of the Mobile & New Orleans.

Zebina C. Campa, great railroad contractor, builder of Vermont Central and other roads, died in Montpelier, Vt.

John B. Brown, prominent in the building of the Atlantic & St. Lawrence, Maine Central, Portland & Ogdensburg, and Portland & Rochester, died in Portland, Me.

Fred. P. Mosely, purchasing agent of the Old Colony railroad and steamship companies, died in Boston.

John S. Daily, cashier of the Chicago, Burlington and Quincy Railroad in Boston, and agent of the associated railways of Virginia and the Carolinas, died in Boston.

Joseph N. Stinson, general depot baggage agent of the Illinois Central, Michigan Central and Chicago, Burlington & Quincy roads, died in Chicago.

James M. Walker, general solicitor of the Chicago, Burlington & Quincy, president of the Union Stock-yards Transit Company, and formerly president of the Chicago, Burlington & Quincy, died in Chicago.

FEBRUARY.

Henry Waters, confidential secretary of General Superintendent Tillinghast, of the New York Central, was instantly killed January 8, by the falling of the roof of the Buffalo passenger depot.

General Robert Thomson, president of the Philadelphia & Erie Railroad Company, died at Philadelphia, aged 53.

A. D. Briggs, one of the railroad commissioners of Massachusetts, a civil engineer and bridge builder, died at Springfield, Mass., aged 61.

E. W. Strader, who was general passenger agent of the Little Miami road from 1848 to 1867, died in Ashtabula, O., aged 73.

MARCH.

Robert Hayes, superintendent of the Woodruff Sleeping and Parlor Coach Company, was run over at Cleveland by a locomotive and instantly killed.

Colonel Darius Hunkins, who was concerned in the construction of the Baltimore & Ohio, of which he was for a time superintendent, subsequently was a contractor on numerous Eastern and Western roads, and was president of the Keokuk Northern Line Packet Company, and president and superintendent of the Galena and Wisconsin, died in Galena, aged 69.

Captain Benjamin H. Fletcher vice-president of the Lockport and Buffalo Railroad Company, died at Lockport, N. Y.

L. B. Boomer, a well known bridge-builder in Chicago, died suddenly in New York. In connection with Mr A. B. Stone, he built the first bridge over the Mississippi River at Rock Island.

T. A. Brooks, master carpenter of the New York division of the Pennsylvania Railroad was killed by a locomotive near Trenton, N. J.

Benj. W. Healy, formerly superintendent of the Rhode Island locomotive works, died at Nicaragua.

Washington L. Hedge, traveling agent for the Red Line Transportation Company, died at Worcester, Mass., aged 51.

John G. Turner, formerly paymaster of the Terre Haute & Indianapolis road, died near Carthage, Mo.

APRIL.

Francis A. Stevens, inventor of the Stevens carbrake, died in Chicago.

Isaac N. Ross, director and formerly superintendent of the Boston, Barre & Gardner Railroad, died in Holden, Mass.

Hocum Hosford, for several years manager of the Boston & Lowell Railroad, died in Lowell, Mass., aged 57.

Edward Huntington, one of the engineers for the construction of the old Utica and Schenectady Railroad, and afterwards engaged on the enlargement of the Erie Canal, died at Utica, N. Y., aged 64.

Richard Meldrum, general western freight agent of the Pittsburg, Fort Wayne & Chicago Railway died at Jacksonville, Fla., aged 59.

William C. Longstreth, for many years President of the Williamsport & Elmira Railroad Company, died in Philadelphia, aged 61.

Thomas Hogg, who in 1837 took the first locomotive west of the Alleghanies, and was afterwards master mechanic on the Mad River & Lake Erie road and on the Sandusky, Mansfield & Newark road died in Danbury, Ohio, aged 73.

MAY.

R. J. Reekie, an extensive railway contractor in this country and abroad, and at one time connected with the Grand Trunk Railway of Canada, died in London, England, aged 70.

Judge John P. Devereux, for a long time land commissioner of the Kansas Pacific Railway, and subsequently in charge of the legal business of the Kansas Pacific and Union Pacific companies in Kansas, died at Lawrence, Kansas, aged 60.

Col. Thomas A. Scott, President of the Pennsylvania Railroad Company for many years and for some time president of the Union Pacific Railway Company and of the Texas & Pacific Railway Company and of many other corporations, died in Philadelphia, May 21, aged 57. He was previously general superintendent and vice-president of the Pennsylvania system, and during the civil war was assistant secretary of war.

Nathan Carruth, the first president of the Old Colony Railroad Company, died in Dorchester, Mass., aged 72.

S. T. De Ford, Jr., formerly western passenger agent of the Chesapeake & Ohio, and Southern passenger agent of the Pennsylvania Railroad, and in 1857, general freight agent of the Marietta & Cincinnati, died at Louisville, Ky.

JUNE.

Colonel George W. Flower, a well known Railway contractor of Watertown, N. Y., died in New York City.

Leonard Phlegar, inventor and mechanical engineer, who ran the first engine on the Philadelphia, Wilmington & Baltimore road, was at one time superintendent of that company's shops at Gray's Ferry, and afterwards in charge of the Philadelphia & Reading shops at Tamaqua, died in Philadelphia.

John M. Courtney, president of the New York & West Shore Railway, aged 56.

JULY.

James Abbott, chief engineer of the Continental Railway, and at one time chief engineer of the Rockfort, Rock Island & St. Louis died at Akron, Ohio.

William S. Hudson, the celebrated locomotive builder, an apprentice of Robert Stephenson, at one time the master mechanic of the Attica and Buffalo Railroad, and later superintendent of the Rogers locomotive works, died near Paterson, N. J., in his 72d year.

Colonel W. Milnor Roberts, the eminent civil engineer, died in Rio de Janeiro, South America, aged 72. He had charge of the surveys of several of the great railways of this country, made plans for the great St. Louis bridge, and at the time of his death was chief engineer of public works for Brazil.

James Robb, formerly president of the Chicago & Alton Railroad Company, died at Cincinnati.

AUGUST.

Joseph H. Moore, formerly superintendent of

the Old Colony Railroad, then of the Michigan Central, later of the eastern division of the Pittsburg, Ft. Wayne & Chicago, and subsequently connected with other roads, died at Odell, Ill., aged 68.

Thomas J. Firth, for many years secretary and afterward treasurer of the Pennsylvania Railroad Company, with which he was connected for thirty-three years, died at Germantown, Pa., aged 78.

Lieutenant Colonel F. W. Cumberland, general manager of the Northern and Northwestern railways of Canada, died in Toronto.

General John A. Clark, land commissioner of the Kansas City, Fort Scott & Gulf Railroad, died at Kansas City.

William G. Fargo, President of the American Express Company, died in Buffalo, N. Y.

William H. Cruger, civil engineer and railway builder for many years, and latterly agent at Peoria for the pooled lines, died at Peoria, Ill, aged 60.

Eber E. Aldrich, superintendent of the Troy & Boston Railroad, died in Troy, N. Y.

Wm. Tomlin, general agent of the Naugatuck Railroad, died at Bridgeport, Conn., aged 57.

James C. Slocum, a prominent railroad contractor, died suddenly at Bradford, Pa.

James H. Williams, director and treasurer of the Rutland Railroad Company, and a director of the Vermont Valley and Cheshire Railroad Companies, died at Bellows Falls, Vt., aged 69.

William Gooderham, who was largely interested in Canadian railways, and whose son is president of the Toledo & Nipissing, died at Toronto, Ont., aged 91.

Colonel Joseph Applegate, formerly president of the Pittsburg, Wheeling & Kentucky Railroad, died at Wellsburg, W. Va., aged 73.

Royal Hill, of Chicago, of the firm of Hill & McKechney, railway contractors, died at Irontown, O., aged 68.

Philo Morehouse, claim agent for the Lake Shore & Michigan Southern road.

George W. Jones, chief of the Car Service Department of the Pennsylvania Railroad, died near Philadelphia, aged about forty years.

SEPTEMBER.

Thomas C. Harvey, master bridge-builder of the Atlanta & Charlotte Air Line, was killed by being struck by a freight train and thrown from a bridge.

Joseph Harvey, lost freight agent of the Michigan Central Railroad, died in Chicago.

George Nason, Superintendent of the Pensacola Railroad and Steamship Company, and for many years division superintendent of the Louisville and Nashville, died at Mobile, Ala.

C. M. Whittier, cashier of the Boston, Concord & Montreal Railroad, died in Littleton, N. H.

Willard Ricketts, formerly president of the Jeffersonville, Madison and Indianapolis road, died in Indianapolis, Ind., aged 63.

Major-General Ambrose E. Burnside, United States Senator from Rhode Island, who was formerly treasurer and director of the Illinois Central, president of the Rhode Island Locomotive Works and president of the Indianapolis & Vincennes and Cincinnati & Martinsville railroad companies, died in Bristol, R. I., aged 51.

John W. Brooks, formerly president of the Michigan Central and the Chicago, Burlington & Quincy companies, died at Heidelberg, Germany.

E. S. Duvol, superintendent of bridges and buildings of the Ohio & Mississippi.

S. C. Scoville, secretary of the Nevada & Oregon Railroad, died from wounds received in a fight at the annual meeting of the company.

OCTOBER.

B. B. Prevost, civil engineer, who was engaged in the construction of the Michigan Southern and Illinois Central roads, died at Dubuque, Ia.

Hon. Edwin B. Morgan, one of the founders of Wells, Fargo & Co., and largely interested, died at Aurora, N. Y., aged 75.

NOVEMBER.

George Hibbert, formerly master car-builder of the Cincinnati Southern road, died at Chattanooga, Tenn.

E. B. McClure, for six years general superintendent of the Indianapolis road, died at Lichfield, Ill.

George Law, a well-known railway builder and owner, one of the builders of the Panama Railroad, and engaged in various steamship and railway enterprises, died in New York, aged 75.

Theodore S. Faxton, first president of the Utica and Black River road, died in Utica, N. Y., aged 87.

William Rushton, for many years master mechanic on the Atlanta and West Point road, died at Atlanta, Ga.

DECEMBER.

E. F. Casement, a well-known railroad contractor, who was largely interested in the construction of the Union Pacific and many other roads, died in New York.

Henry G. Stebbins, once president of the Atlantic & Great Western and Texas & Pacific railroad companies, died in New York, aged 79.

Dr. A. Teal, many years ago a master mechanic of the Chicago, Burlington & Quincy, died at Dunlap, Iowa.

Colonel J. T. Snead, president of the Continental Railroad Company, died at New York, aged 61.

Henry C. Wentworth, for many years general passenger and ticket agent of the Michigan Central Railroad, died in Chicago, December 28, of a spinal affection from which he had long suffered.

LITERATURE.

A PLAT AND PROFILE BOOK FOR CIVIL ENGINEERS AND CONTRACTORS. Published at office of ENGINEERING NEWS, 1882. Price, $1.

Every engineer knows how troublesome and tedious it is to have to carry a long roll of profile for reference in the field, or to roll and unroll from end to end in an office. The writer, who has had a large experience in railroad surveying and construction, has endeavored to assist himself and his brother engineers by preparing for use his "Plat and Profile Book." In his Preface he says: "Engineers are aware that in the construction of railways and public works much valuable time is lost in looking through transit and level books, and in referring to office plans and profiles for notes and data that must be frequently used in the field. The writer has found a pocket-book of this size convenient for mapping to scale (400 ft. to 1 in.), and recording notes of alignment, right of way, reference points, bench marks, etc., which, in the work of construction, are no less important than the profile itself. The few tables copied from Trautwine's valuable 'Pocket Book' are inserted for reference in the field, the table of quantities being especially for the convenience of contractors, who will also find the left-hand page of the book of much service for noting amounts of estimates and dates of sub-contracts. The book is made up of three pages of tables, one of excavation and embankments, for 100 ft. prismoids, slope 1½ to 1; bases, 12 to 28 ft., and height, 6 in. to 100 ft.; a table of strength and weight of various materials, giving tensile strength, crushing load, weight per cubic foot, and weight of bar iron in pounds, and a table showing the number of acres of covered (as in cities) surface, from which circular sewers, with junctions properly connected by easy curves, will convey away the water-fall of a rain of one inch per hour, with house drainage besides, giving slope of sewer from level to 1 in 60, with sewer 2 ft. to 10 ft. diameter; there is a page for index, and then 37 pages are devoted to profile paper, neatly engraved, and allowing three sections, or thirty ordinary divisions to the page, usually equal to 3,000 ft. length, by four divisions, or 100 ft. height. The opposite pages are blank. The book is bound in flexible covers, and is 9½ in. long by 4 in. wide, and less then a quarter inch thick. It supplies, in a convenient shape, a long-felt want among engineers, surveyors and contractors, and the price—one dollar—places it within easy reach of a trial of its merits. They are for sale wholesale and retail, at this office only, and we invite the attention of the profession to it as a convenient book of reference and a labor-saving contrivance prepared specially for them.

SEWERAGE OF EUROPEAN CITIES.

PART IV.—VIENNA.

Population.

City proper	730,000
Contributing to sewers, over	1,000,000

Area.

City proper (4,200 hectares) acres	10,379
Sewerage area (6,300 hectares) "	15,568

Dwellings.

Number of houses	12,774
Number of dwellings	143,617

Water Supply.

Max. daily which can be delivered, gallons	29,847,933
Daily summer consumption "	16,441,985
" winter "	12,705,183

Obtained from mountain creeks by gravity for domestic purposes, about 16 gal. per head daily.

Mortality.

Varies from	28.2 to 38.7
Mean for several years	30.6

Meteorological.

	Fahr.
Temperature, mean annual	49.46
" highest	101.84
" lowest	13.90
Mean max. annual	93.02
" min. "	4.82
" summer months	67.10
" winter "	31.00
" yearly rainfall (inches)	22½
Max. " "	31

Topographical.

Situated on the right bank of the Danube, the city is intersected by the Donau Canal, a branch of the river. The surface between the latter and the Danube is almost a level, and is 13 to 18 ft. above the low-water level. The rest of the city is on a gradually sloping and undulating ground, closed in by hills.

Physical.

The flat territory between the canal and the river is mostly open; a small district near the former is built up. In the northwest, the ground is as yet unimproved or covered with scattered buildings. In the southwest, the territory is converted into a park (Prater). The pavements are granite blocks, and recently have been replaced by asphalt to some extent. In open territory they are macadam.

MANAGEMENT OF PUBLIC WORKS.

All public works are under a "general director." The separate departments are as follows:

I. Architecture, for public buildings and grounds.

II. Water supply.

III. Rivers, canals and sewerage; headed by a chief engineer, with a staff of two principal assistants, one for each half of the city, eight assistants, for general design and maintenance, and a large staff of clerks and inspectors.

IV. Streets and bridges, and

V. Fire department.

The yearly budget is about $8,000,000. New works, as well as the maintenance of existing works, are done by contract.

DESIGN AND CONSTRUCTION OF SEWERAGE WORKS.

I.—GENERAL SYSTEM AND ALIGNMENT.

Combined water-carriage, with some dry removal, which is gradually being abandoned. System is not satisfactory on account of many old and improperly designed works. New works are gradually replacing and supplementing them. Since 1859 the question has received systematic treatment. All sewage discharges into the Donau Canal. At present there is a project to build an intercepting sewer along its entire eastern bank, discharging into the Danube several miles below the city. The Wien River is preserved from contamination by an intercepting sewer on each shore; a third one protects the extensive flat ground in the south from the storm-water of the adjoining high grounds. The rest of the sewers are along the valley lines, several of them inclosing creeks originating in adjacent mountains.

II.—IN STREETS, ETC.

Shape and size of sewers.

Pipe sewers are not used, but will shortly be introduced for house branches only. The shape of the sewers is oval, the invert is rather flat, with a radius but a little less than that of the arch. The older sewers, especially those carrying creeks, are of various shapes, generally with a level bottom and semicircular arch. The debris is less likely to block up a flat bottom than a semicircular one. The sewers are all sufficiently large to be entered, which requirement determines their minimum size. The capacity is calculated, according to Darcy and Bazin's formula, in the following form:

$$\text{Mean velocity per second} = \frac{\sqrt{\frac{\text{sect. area}}{\text{perimeter}} \times \text{sine of slope}}}{A + B\frac{\text{perimeter}}{\text{sect. area}}}$$

A = .00019; B = .00013.

Formerly Eytelwein's formula was used. The maximum rainfall calculated to be provided for is over 1 in. per hour, supposing ⅓ of an inch to get into the sewers, and to fill them only to the spring. The sizes are divided into types, with the dimensions as follows, in meters:

Type.	Height at key.	Width at spring.	Invert radius.
I.	1.10	0.80	0.338
II.	1.26	0.84	0.35
III.	1.35	0.90	0.367
IV.	1.50	1.00	0.42
V.	1.65	1.10	0.45
VI.	1.80	1.20	0.50

For house branches the size ordinarily used is:

VII.	1.05	0.60	0.22

Larger sewers, with spans to 20 ft., with flat bottoms, are used for carrying old creeks.

Depth and grade of sewers.

The depth of sewers below the pavement varies in general from 10 ft. to 15 ft.

The grades, on account of the undulating surface, are as a rule very good. The maximum grade is 0.027 (1:37). The minimum grade is 0.0016 (1:608). The grade for the intercepting sewers is 0.0022 (1:455). The common grades for ordinary sewers are about 1:100.

Junctions, connections, overflows, outfalls.

Junctions of sewers are usually built at 45°, or are tangential, with comparatively small radius. Sewers which are too large ever to get filled join the others at 70 to 90°.

The house branches usually terminate at right angles, as in Paris.

Overflows are built at various places in the two intercepting sewers along the Wien River.

For the proposed main interceptor along the Donau Canal, overflows will be put opposite every valley-line sewer discharging into it.

All the present outfalls are along the Donau Canal at different elevations, varying from mean to ordinary high water. They are unsightly and obnoxious.

(TO BE CONTINUED.)

* From Rudolph Hering's report to the National Board of Health.